Strategies for High Performance Renovation on a Budget

Affordable Energy-Efficiency in an Existing Facility

Presented by:

Douglas R Hundley Jr PE CGD LEED AP CxA
Principal
CMTA Consulting Engineers

Steven R Ward AIA
Architect/Partner
Studio Kremer Architects

Michael Salsman
President
BCD Inc

Chuck Thompson
Former Director of Facilities
Nelson County Schools

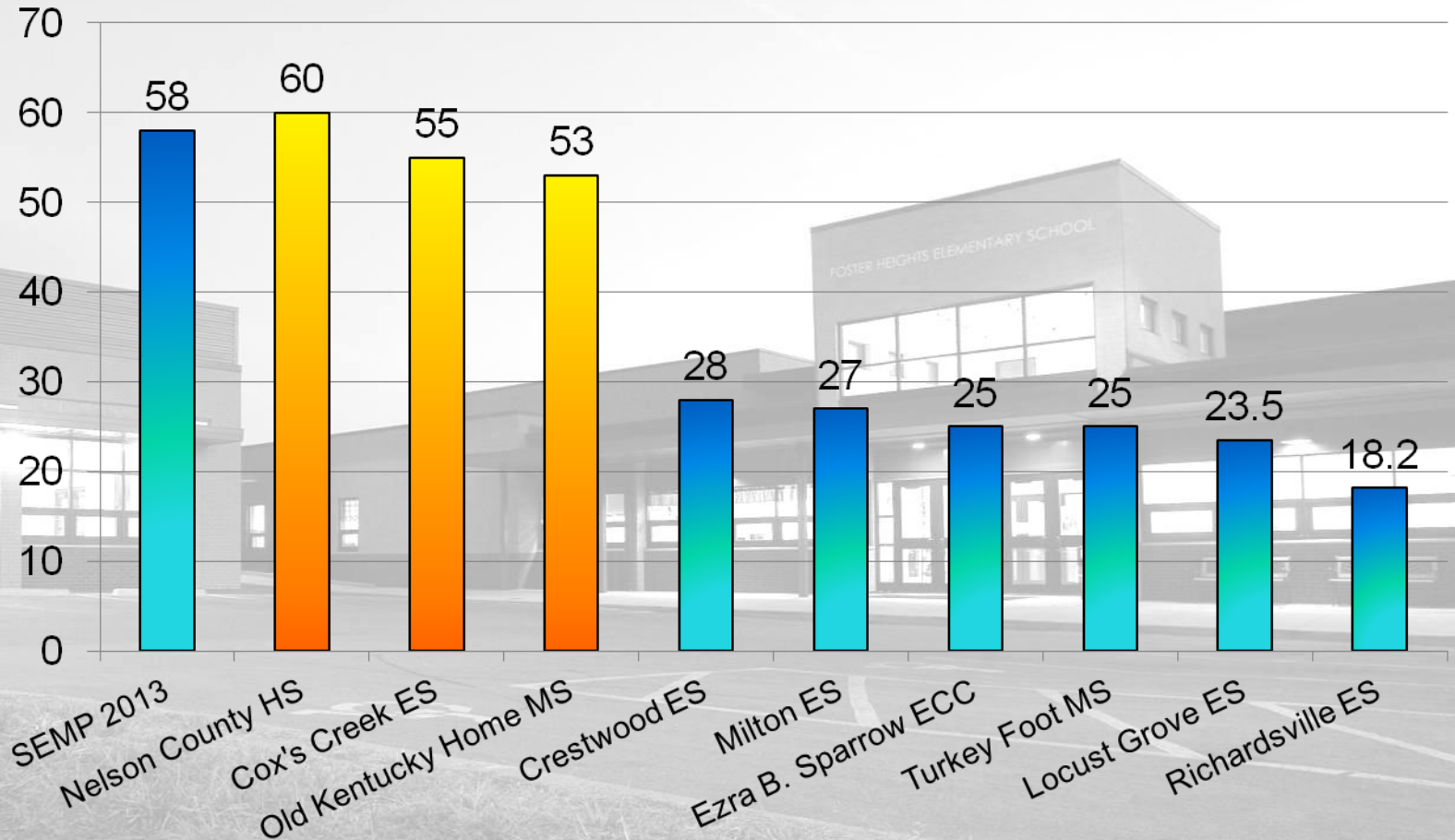
Introductions

What is high performance
and what is the typical cost?

Baseline Energy Usage

Buildings Energy Data Book – U.S. Department of Energy	**68 kBtu/sf yr (Elementary School)**
ENERGY STAR Target Finder Score 50	**47 kBtu/sf yr (Elementary/Middle)**
School Energy Management Project	
– 2011 (FH achieved Energy Star)	**63 kBtu/sf yr (Kentucky Schools)**
– 2013 (Current)	**58.3 kBtu/sf yr**

How much energy does a high performance school use?



Cost

According to the “2013 Annual School Construction Report” published by *School Planning and Management*:

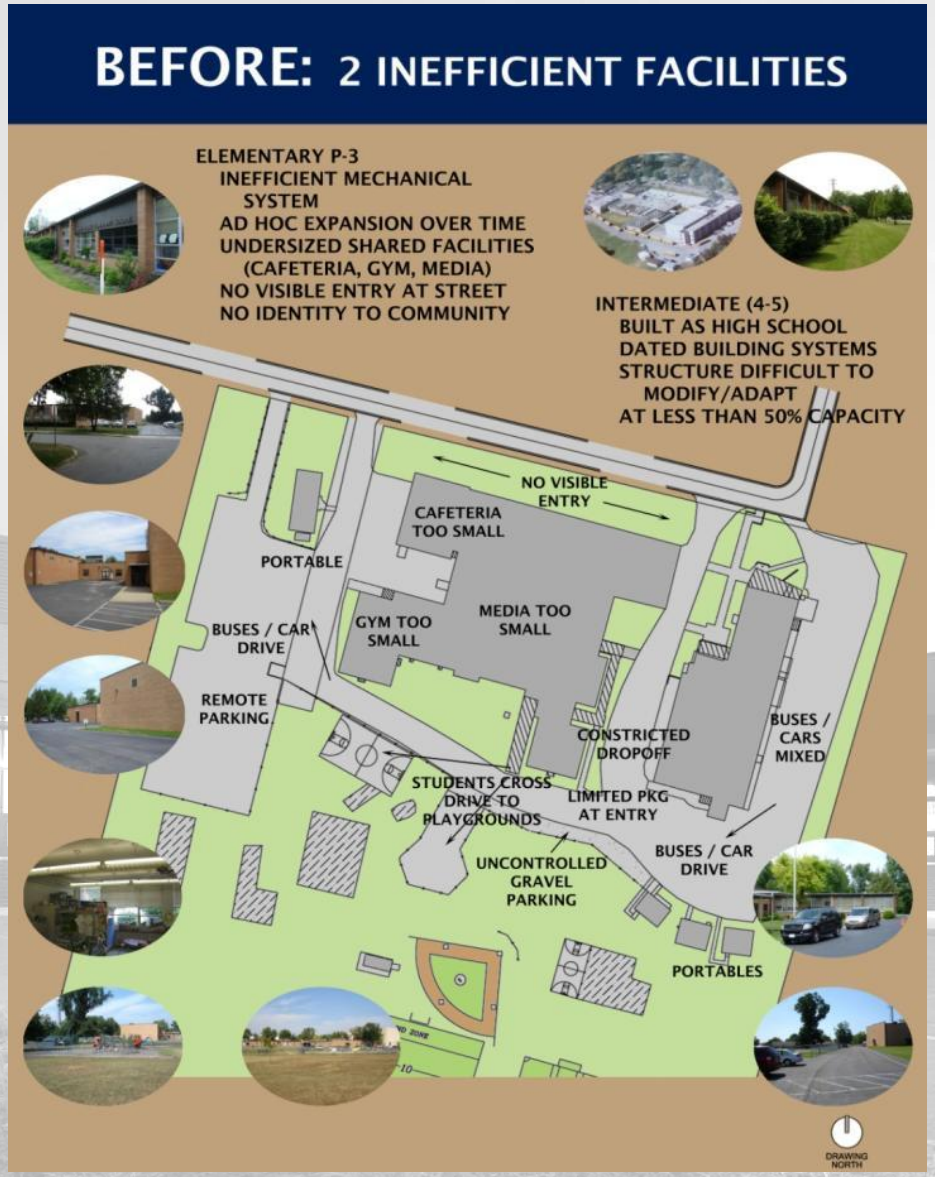
- Median regional (KY, NC, SC, TN) construction cost
  - Elementary School - $200.00/sf new; $55.00/sf reno
- National median construction cost
  - Elementary School - $204.00/sf new; $60.00/sf reno

Case Study 1:

Case Study 1: Foster Heights Elementary

- **Existing school built in multiple sections: 1958, 1970, 1978 and 1992.**
- **Adjacent former high school was used as an intermediate school (grades 4-5) due to overcrowding at Foster Heights.**
- **The district had to decide whether to:**
  - **Renovate both facilities**
  - **Renovate one and retire the other, or**
  - **Tear down and replace the elementary school with a new building**

BEFORE: 2 INEFFICIENT FACILITIES



Team History

- **BCD and Nelson County Schools had been partners in a variety of construction projects over 15 years.**
- **Studio Kremer had begun working with Nelson County Schools and BCD in 2004 and had completed several successful projects.**
- **Studio Kremer and CMTA had worked on several successful projects before, but this was the first project for CMTA in Nelson County.**

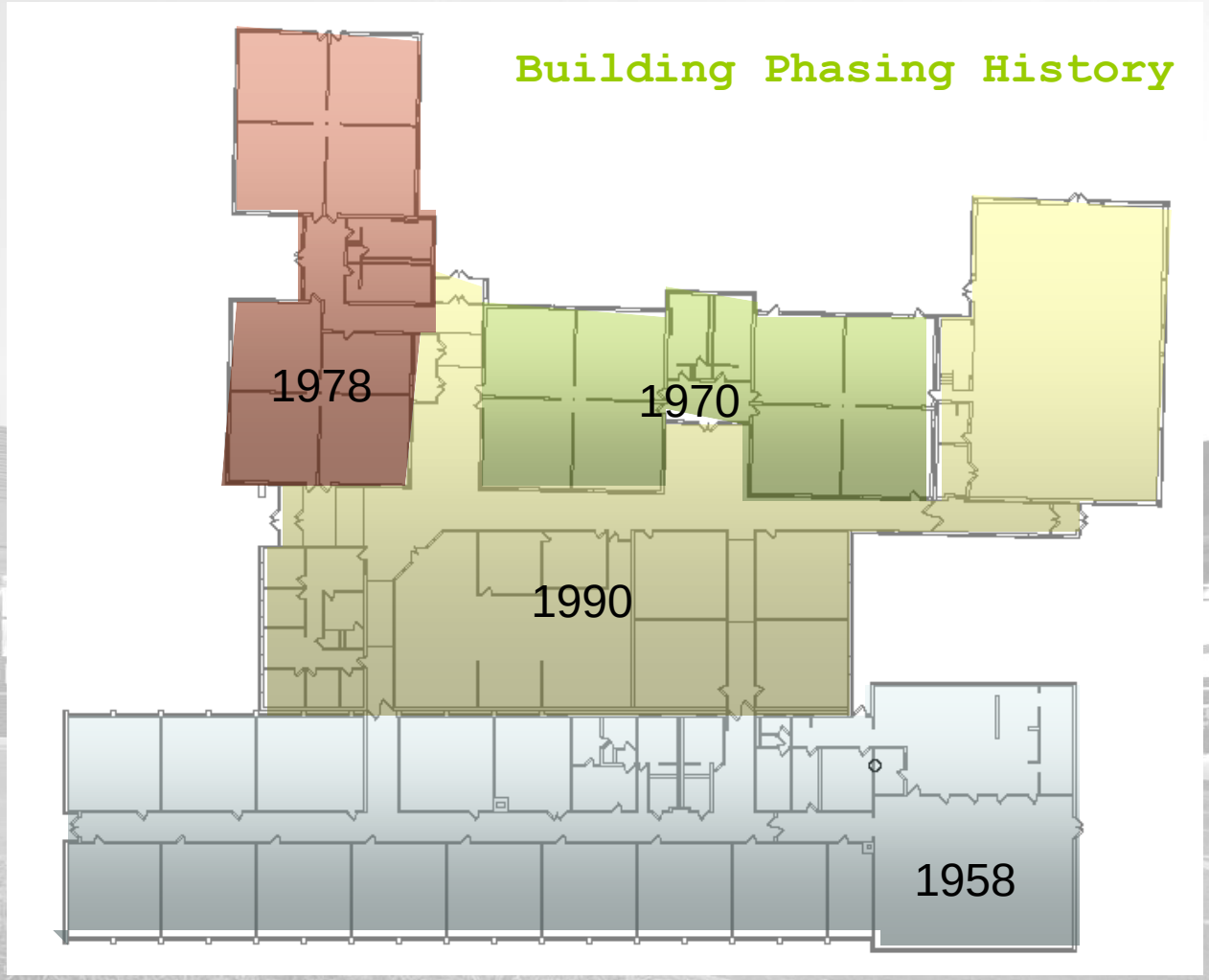
Boston School

NCHS Multi-Purpose

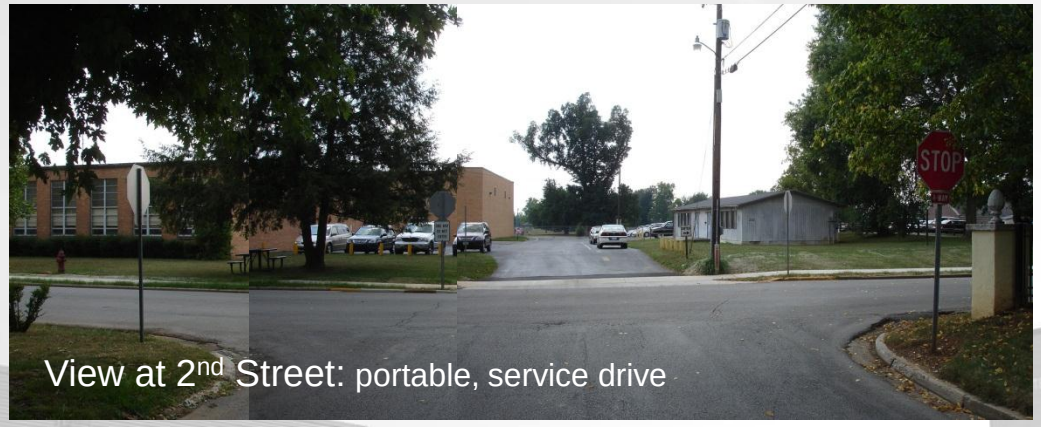
Area Technology Center

Central Office & Alternative School

Existing Building Condition



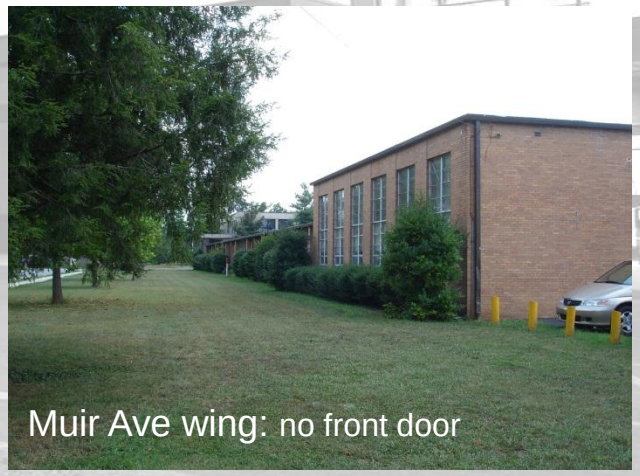
Existing Building Condition



View at 2nd Street: portable, service drive

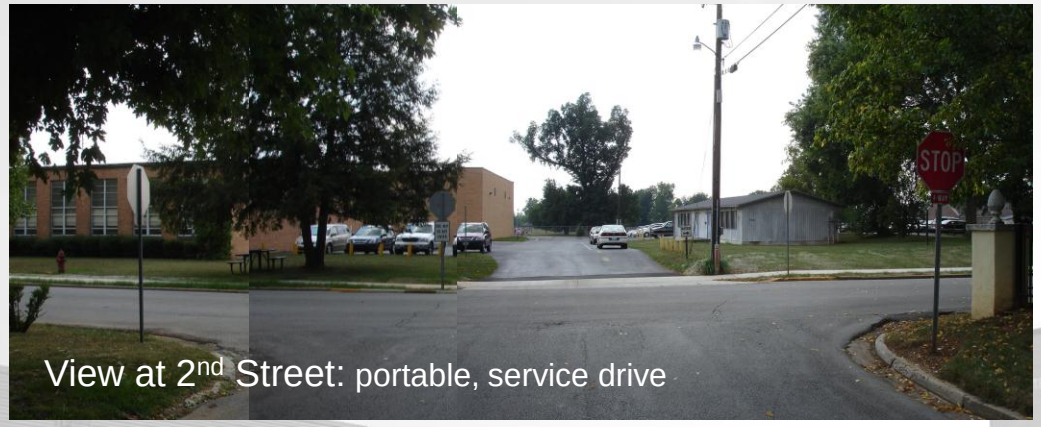

Muir Ave wing: single glazed alum wdws


View at 2nd Street: service access


Muir Ave wing: no front door


West side: paved yard

Existing Building Condition



View at 2nd Street: portable, service drive

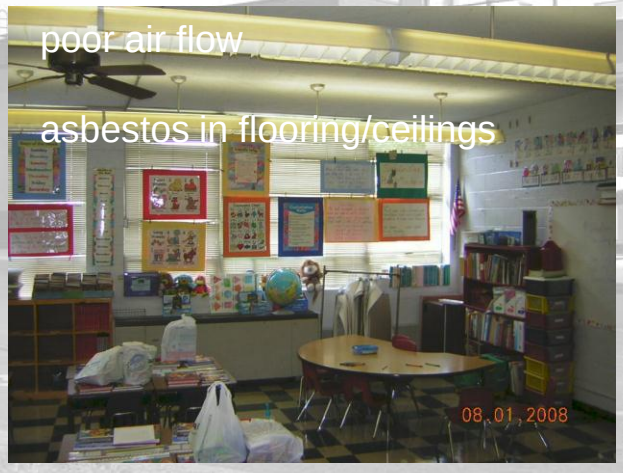

Muir Ave wing: single glazed alum wdws


View at back: must cross drive to playgrounds


Muir Ave wing


East side driveway: main entry

Existing Building Condition



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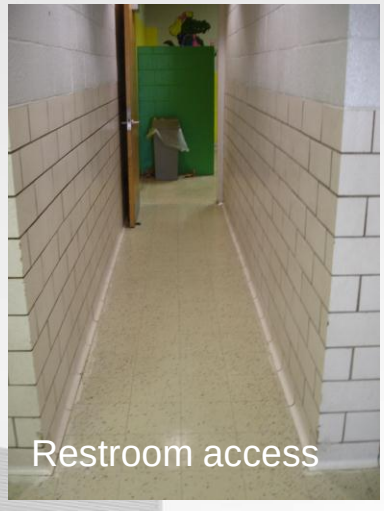
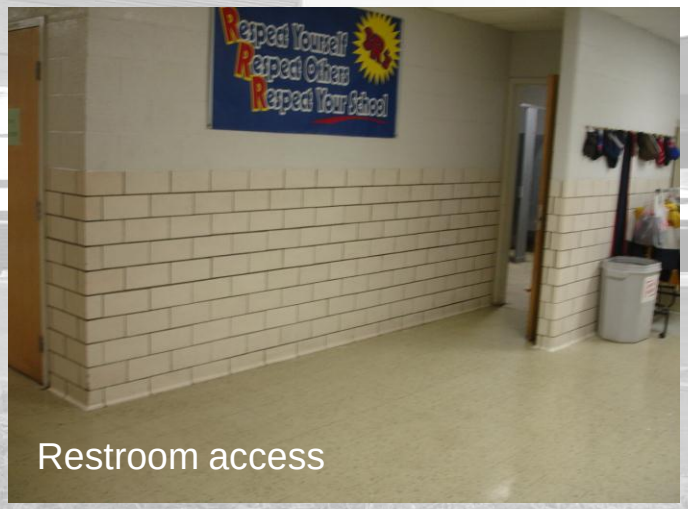

Restroom access

Undersized Gym


ACM



Restroom access

Insufficient Administrative space

Teamwork

- **All parties involved from the outset: Facilities Director; Maintenance Director; Architects; Structural Engineer; Civil Engineer; MEP Engineers; Construction Manager**
- **Established bi-weekly meeting (minimum) at beginning of design with benchmarks established for each meeting.**
- **Construction Manager coordination with design team: constructability issues addressed in the design phase; design proposals tracked with budget; potential efficiencies in schedule, detailing, or construction methods considered.**
- **With everyone involved from the outset, everyone knows project goals and how the design has evolved to address those goals. When questions arise during construction, parties already understand ways to answer these questions that will be consistent with the project goals.**

Case Study 1: Foster Heights Elementary

- **Existing school built in multiple sections: 1958, 1970, 1978 and 1992.**
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- **The district had to decide whether to:**
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- **The design team prepared a master plan recommending two phases of renovation of the elementary school and retirement of the intermediate school facility.**

BEFORE: 2 INEFFICIENT FACILITIES

ELEMENTARY P-3
- INEFFICIENT MECHANICAL SYSTEM
- AD HOC EXPANSION OVER TIME
- UNDERSIZED SHARED FACILITIES (CAFETERIA, GYM, MEDIA)
- NO VISIBLE ENTRY AT STREET
- NO IDENTITY TO COMMUNITY

INTERMEDIATE (4-5)
- BUILT AS HIGH SCHOOL
- DATED BUILDING SYSTEMS
- STRUCTURE DIFFICULT TO MODIFY/ADAPT
- AT LESS THAN 50% CAPACITY

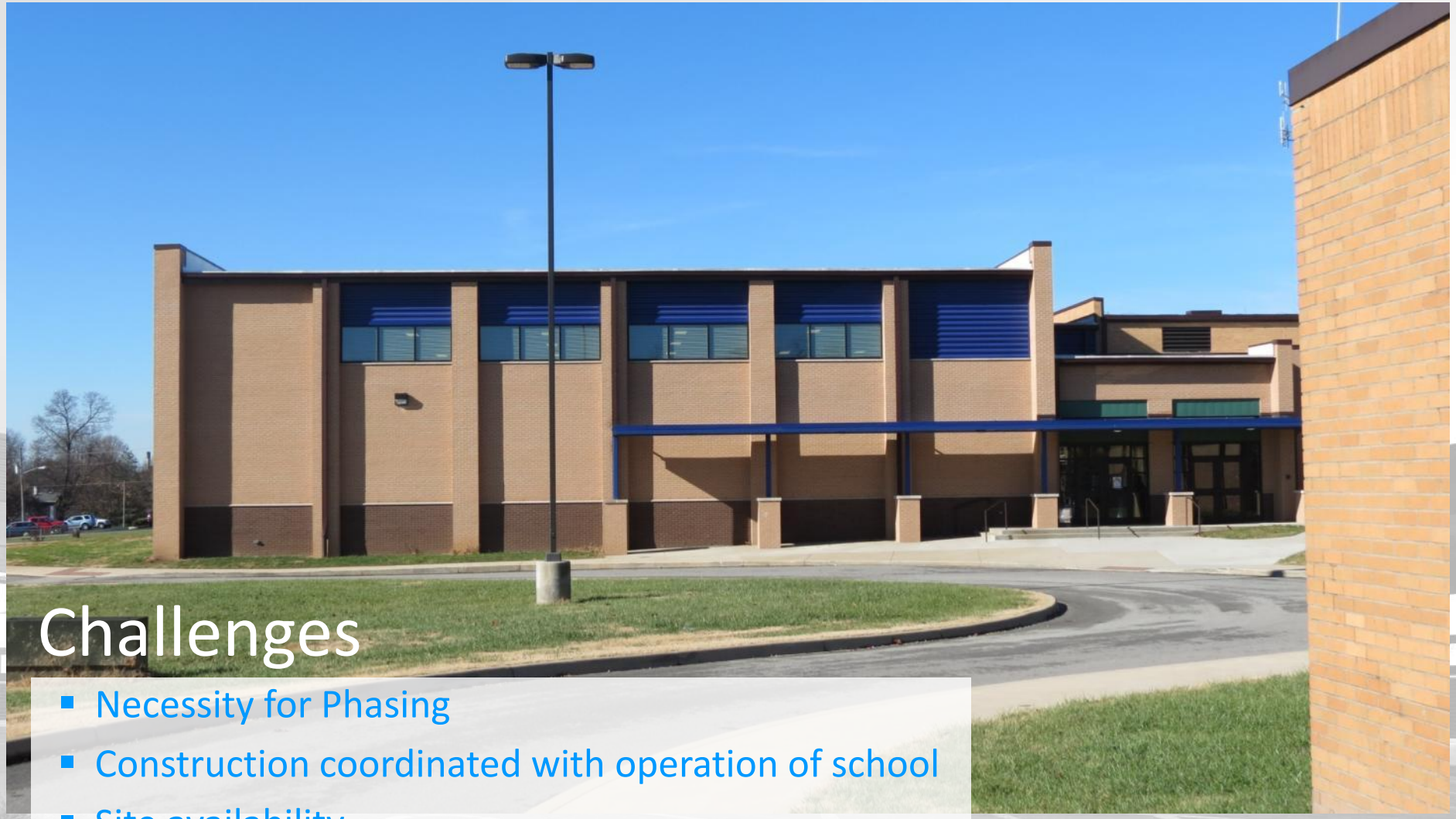
NOW: 1 CONSOLIDATED FACILITY

ENERGY STAR

ELEMENTARY 1-5
- SINGLE FACILITY ACCOMODATES 1 THROUGH 5
- ELIMINATES SECOND SCHOOL BLDG & REDUNDANT ADMINISTRATION
- FULLY RENOVATED + EXPANDED FACILITIES
- DEDICATED BUS TRAFFIC, PARKING & DROPOFF FOR SAFETY

Summary bullet points

- Phase 1: 75,575 sf
  - Energy Use Index 29 (2010)
  - Annual energy cost: $61,480 or $0.81/sf
- with Phase 2: 88,308 sf
  - Energy Use Index 26 (2013)
  - Annual energy cost: $66,000 or $0.75/sf
  - $9,167,000 / $104/sf



Challenges

- Necessity for Phasing
- Construction coordinated with operation of school
- Site availability
- Mechanical space

Strategies for Energy Savings

- **Use of Geothermal HVAC**
- **Dedicated Outdoor Air Systems (DOAS)**
- **Packaged DX w/ Energy Recovery**
- **High Performance Fluorescent Lighting**
- **Simplified Kitchen Equipment**
- **Two-stage High Efficiency Heat Pumps w/ non-centralized pumping**

Strategies for Cost Savings

- Utilizing one heat pump to serve two classrooms
- No anti-freeze/glycol in geothermal loop
- Geothermal well insulation
- Optimize wellfield design
- Minimize kitchen equipment cost
- Better windows = fewer geothermal wells
- Maximum reuse of existing spaces and materials

Lessons Learned

- Be attentive to eave construction > humidity issues
- Be realistic about future phasing / addition plans
- This project's successes opened the door to deeper discussions of energy savings with the district

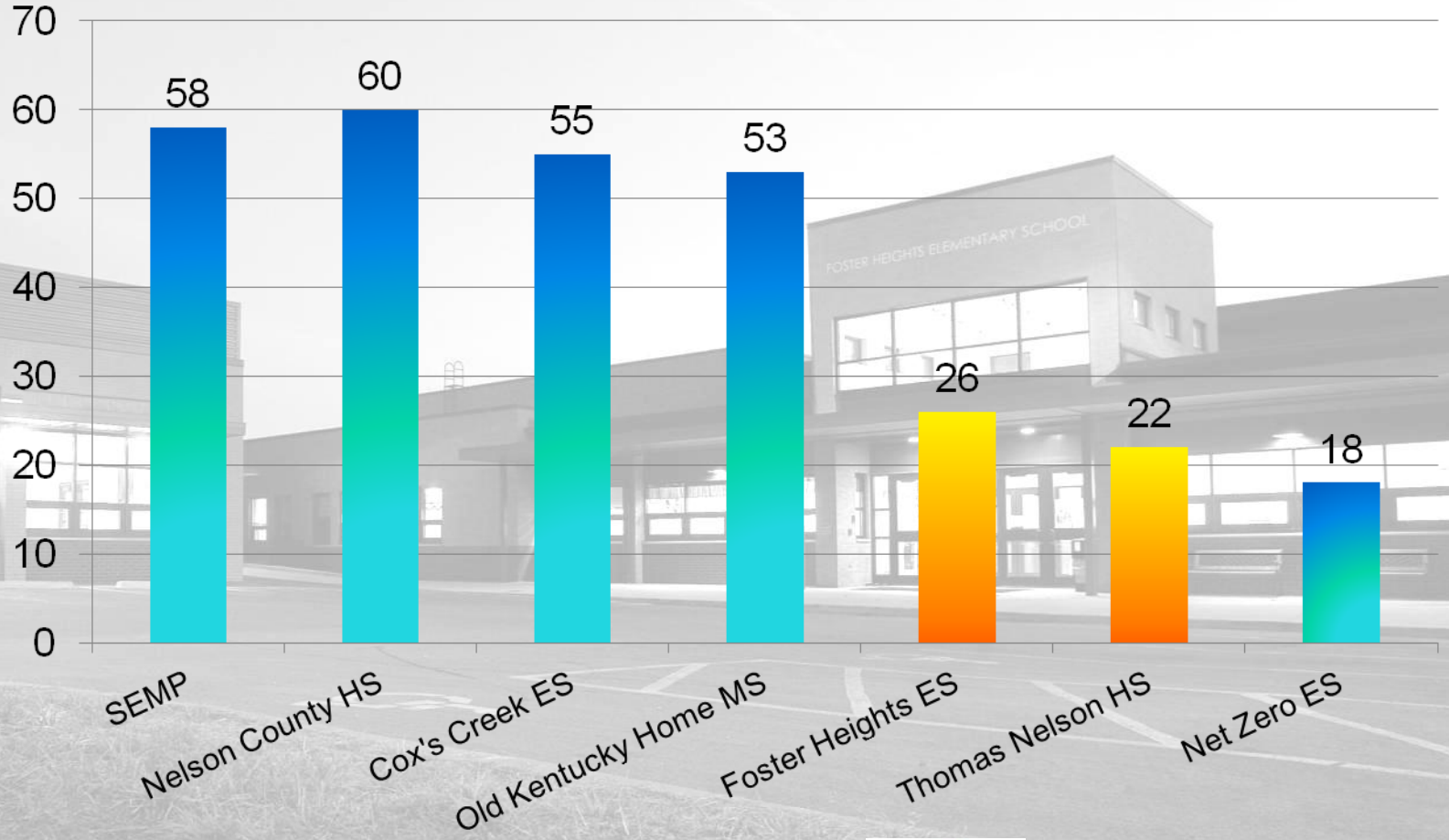
Savings

- **After one year in use Phase 1 showed performance results that met the ENERGY STAR requirements with a score of 99 out of 100.**
- **After Phase 1 completion, the EUI was 29, less than half that of a typical new school.**
- **After Phase 2 completion, the current EUI is now 26. Improvements can be attributed to the nature of the spaces added and to school/district operation.**

Savings

Annual Energy Costs		
Foster Heights Elementary School (26 kBtu/sf yr)	$66,000	
Regional Median Elementary School (68 kBtu/sf yr)	$158,700	($92,700)
Average Kentucky School, 2011 (63 kBtu/sf yr)	$147,000	($81,000)
Average Kentucky School, 2013 (58 kBtu/sf yr)	$135,333	($69,333)
Average Teacher's Salary in Kentucky	$50,000	Energy savings > 1 teacher's salary (annually)

How much energy does a high performance school use?



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